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grooved portion substantially conforms to the at least a part of the lower area of the semiconductor wafers that contact the arcuate lower grooved portion and which supports the weight of the semiconductor wafer positioned thereon; and

- d) at least one window positioned a minimum of about 10 mm from the first and second ends of the boat, whereby the one or more windows increase radiation view factors and decrease radiation blocking of the wafers in the boat when the boat undergoes processing at elevated temperatures.

### REMARKS

Upon entry of the present amendment, claims 1-8 are pending in this application. The present amendment does not introduce new matter.

Claims 1-8 have been rejected.

Claim 1 has been amended. Support for the amendments in claim 1 can be found in the specification on page 9, line 11 to page 10, lines 17; and page 11, lines 15-18.

Attached hereto is a marked-up version of the changes made to the claims by the current amendment. The attached page is captioned "VERSION WITH MARKINGS TO SHOW CHANGES MADE".

The Examiner's rejections and objections will be addressed in turn as set forth in the Office Action.

### **I. DRAWINGS**

The proposed drawing correction to Figure 1 submitted in Applicant's Response filed on August 02, 2002 has again been objected to. The Office Action recites that the proposed substitute sheets of drawing are not approved because the photo copy of the drawings are very dark and do not show detail features of the drawings. The Examiner has requested that Applicant resubmit the proposed corrections for the Examiner's review.

Applicant has obtained new formal drawings for Figs. 1-4, which are submitted herewith. Applicant respectfully submits that the figures are now in accordance with all U.S. Patent Office regulations on figures and respectfully requests that the objections to the drawings be withdrawn.

## **II. INFORMATION DISCLOSURE STATEMENT**

The present Office Action recites that the IDS filed on February 21, 2002 has not been considered because the filed IDS of Japanese patents 01302814, 04287915 and 05144756 are incomplete and because the Response of August 02, 2002 submitted only the first page of the Abstract of each of the Japanese references. The present Office Action requires the submission of a complete copy of each of the aforementioned Japanese references. Accordingly, complete copies of each of the Japanese references accompany this Response for the Examiner's consideration.

## **III. THE SPECIFICATION**

The specification has been objected to as failing to provide proper antecedent basis for the claimed subject matter. In particular, the Office Action recites that there is no support in the disclosure for the claimed subject matter of the window to be positioned "not more than" 10 mm from the first and second ends of the boat. The Office Action recites that the disclosure on page 11, lines 18-19 does not set forth a restriction for the windows to be located not more than 10 mm away from the boat ends. Further, the Office Action recites that there is no support in the disclosure for the windows to "increase radiation distribution," see page 11, lines 16-18.

Claim 1 subpart d) has been amended so that the claimed subject matter therein is now supported by the disclosure. More specifically, the recitation of "a minimum of about 10mm" is supported in the disclosure on page 10, lines 15-17, and the recitation of "radiation view factors and decrease in radiation blocking" is supported in the disclosure on page 11, lines 15-18. Since the claimed subject matter is now adequately supported in the specification, Applicant respectfully requests the withdrawal of this objection.

## **IV. REJECTION UNDER 35 U.S.C §112, PARAGRAPH TWO**

Claims 1 has been rejected under 35 U.S.C §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The Examiner states that with respect to claim 1, the claim uses a functional "wherein" clause that fails to particularly point out and distinctly claim the subject matter by only alludes to the merit of purposes.

As recited in the section pertaining to the objection to the specification (section III above), Applicant has amended claim 1 so that the claimed language is supported by the specification. The

“wherein” phrase in amended claim 1 is supported in the specification on page 11, lines 15-18. The merit of the purpose of the language in the “wherein” phrase is recited in the specification and in the Experimental portion of application on page 14, where the advantages of the wafer boat of the present invention is set forth in comparison with the use of standard conti wafer boats. In order to expedite the advancement of this application to allowance, however, the term “wherein” in claim 1 has been amended to the term “whereby”. The “whereby” clause in amended claim 1 is proper since the function stated as the object of the “whereby” clause necessarily follows from the previously recited structure in the claim and as supported by the specification. *See* MPEP § 2173.05(g).

Accordingly, Applicants respectfully submit that there is adequate support in the specification for the amended “whereby” phrase and that the Examiner’s assertion that the “wherein” phrase is improper is erroneous. Reconsideration and withdrawal of the rejection on these grounds is respectfully solicited.

#### V. REJECTION UNDER 35 U.S.C §103

Claims 1-8 stand rejected under 35 U.S.C §103(a) as being unpatentable over U.S. Pat. No. 5,538,230 to Sibley (hereafter referred to as “*Sibley*”). The Examiner states on page 6 of the present Office Action that “*Sibley* does not teach or suggest the window that serves the purpose of [sic] increase radiation distribution, it should be noted that how the rack is to be used is normally not germane to issue of patentability, especially if applicant’s structure, even in view of the claim language, differs in no way from prior art structure (*Ex parte Wikdahl*, BdPatApp & Inter, 1/25/89, p. 1546).”

Obviousness requires that there be some motivation, suggestion, or teaching of the desirability of making the specific combination that was made by the applicant. (*In re Kotzab*, 55 USPQ2d 1313, 1317 (Fed. Cir. 2000)). Additionally, all the claimed limitations must be taught or suggested by the prior art. (*In re Royka*, 180 U.S.P.Q. 580 (CCPA 1974)). Neither of these requirements have been satisfied.

As recited in Applicant’s previous responses dated June 4, 2001, September 4, 2001 and resubmitted on August 02, 2002, *Sibley* is directed to a wafer carrier comprised of a single piece of silicon carbide configured as a cylindrical shell section (22) and which has an outer convex surface (23) and an inner concave surface (24). The cylindrical shell (22) lies outside the radius of inner concave surface (24). The boat (20) disclosed in *Sibley* has four slot-containing inwardly convex

surfaces (34) which extend toward the wafer center to a distance  $r_3$ . Surfaces (34) are provided with a plurality of grooves or slots (35) into which the wafers are placed. This embodiment is illustrated in Fig. 1 of *Sibley*. In an alternative embodiment disclosed in *Sibley*, and illustrated in Fig. 3, the boat is provided with only two inwardly extending surfaces (34), each of which has a row of slots (35) equally spaced along the longitudinal axis of the cylindrical shell. Additionally, *Sibley* discloses in Col. 5, lines 19-20, "cut outs" (32), which are shown in Fig. 1 and Fig. 2 of *Sibley* as being located on the outer convex surface (23) of the boat, and which may be used to insert lifting devices from the side. *Sibley* further discloses "other cut outs" (33) in base (30) to permit the flow of process gases as well as to decrease the weight of the boat by removing unnecessary mass. (Col. 5, lines 20-22).

As described on pages 9-10 of the present application, the windows between each end of the boat increases radiation view factors and decreases radiation blocking of the wafers by the boat. Page 9-10 of the instant application teaches that a detailed analysis of the heat transfer from the furnace to the wafers demonstrated that radiation is the dominant contributor to heat transfer at high temperatures. In other words, wafer areas that are exposed to radiation will heat up quickly. As stated on page 7, lines 7-8 of the present application, silicon strength decreases significantly at temperatures above about 900 °C. The specification at page 9 further explains a geometric relationship that exists between the source (the furnace tube in the furnace system) and the target (the wafers), which is referred to as the radiation view factor. The radiation view factor defines how much of the radiant energy leave the source actually hits the target. The windows in the wafer boat of the present invention are essential for increasing the radiation view factors and decreasing blocking caused by the boat so that the maximum amount of radiation reaches the target (the wafers). Furthermore, page 10, lines 12-14 of the instant specification recites that wafer boats that have windows or cutouts close to the edge of the boat are prone to mechanical damage during manufacturing and in subsequent use. As such, the inventor has determined that windows should be positioned a minimum of about 10 mm from the boat end or any sharp transitions. (Specification, page 10, lines 15-17)

With all due respect, the Examiner's citation of *Ex Parte Wikdahl* is not entirely on point nor applicable to the present application. In stating that "the manner in which a machine or method is to be utilized is normally not germane to the issue of patentability especially where, ... appellant's structure, even in view of the claim language, differs in no way from the structure in [the prior art

reference]”, the Board noted that the structure in the claim was an apparatus that was “structurally indistinguishable” from the structure in the prior art reference. This is not the situation that exists with regard to the present application. The semiconductor wafer boat as recited in amended claim 1 is not “structurally indistinguishable” from the wafer boat in *Sibley*. Numerous differences exist between the wafer boat of the present invention as recited in amended claim 1 and the wafer boat of *Sibley*. *Sibley* does not teach or suggest the wafer boat of the present invention. *Sibley* is not directed to solving the same problem that the wafer boat of the present invention solves. *Sibley* does not teach or suggest a wafer boat as in amended claim 1 having windows between each end of the boat which **increase radiation view factors and decrease radiation blocking of the wafers in the boat when the boat undergoes processing at elevated temperatures.** (emphasis added) As recited in Applicant’s prior Responses, nor does *Sibley* teach “**a lower arcuate grooved portion for receiving and supporting the lower area of the semiconductor wafers,** wherein at least a part of the lower area of the semiconductor wafers contacts the lower arcuate grooved portion such that the lower arcuate grooved portion **substantially conforms to the at least a part of the lower area of the semiconductor wafers that contact the arcuate lower grooved portion** and which supports the weight of the semiconductor wafer positioned thereon;” as recited in element c) of amended claim 1. (emphasis added)

Moreover, the wafer boat of the present invention is configured (as recited in amended claim 1) to reduce the likelihood of wafer slip (described in specification on page 4, line 17 – page 5, line 9) when wafers are heated to processing temperatures in excess of about 1000 °C. As further recited in the application, the material of the boat is selected, and the arcuate lower grooved portion is shaped, such that when the wafer and boat are subjected to wafer processing temperatures of about 1000 °C and above, the shape of the grooved portion will substantially correspond to the shape of the wafer contacting the groove, thereby supporting the wafer across the entire arc over which the wafer is contacted by the lower grooved portion. With respect to the element of wafer processing at temperatures between approximately 1000 °C to 1400 °C, Applicant notes that *Sibley*, in Col. 6, lines 44-48 teaches that unlike the prior art in previously cited references which generally refer to high temperature processing, “the present invention includes the use of the CVD SiC component in operations that are performed at lower temperatures, including room temperature or below.

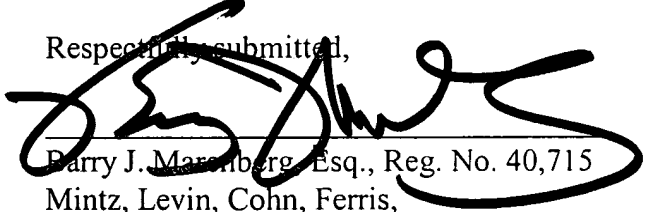
By the amendments made to claim 1, and the arguments submitted herein applicant believes that the semiconductor wafer boat of amended claim 1 is not obvious in view *Sibley*. Claims 2-8 depend directly or indirectly from amended claim 1 and thus incorporate all the limitations of amended claim 1 therein. Since amended claim 1 is believed to be non-obvious and allowable, claims 2-8 are believed to be allowable for at least the same reasons. (*In re Fine*, 5 U.S.P.Q.2d 1596 (Fed. Cir. 1988)). Reconsideration and withdrawal of the rejection on these grounds is respectfully solicited.

## VI. CONCLUSION

Applicant has made a significant contribution to the art, neither disclosed nor suggested in any cited reference. It is submitted that all claims are in condition for immediate allowance, which action is respectfully solicited.

**If, upon receipt and review of this amendment, the Examiner believes that the present application is not in condition for allowance and that changes can be suggested which would place the claims in allowable form, the Examiner is respectfully requested to call Applicant's undersigned counsel at the number provided below.**

Respectfully submitted,



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**VERSION WITH MARKINGS TO SHOW CHANGES MADE**

**In the claims:**

Claim1 has been amended as follows:

1. (Four Times Amended) A semiconductor wafer boat comprising:

- a) a first end and a second end;
- b) a plurality of slots positioned between the first and second ends for receiving semiconductor wafers therein, the semiconductor wafers being substantially circular and having an upper area and a lower area, each of the slots comprises first and second upper support guides to maintain the semiconductor wafers in a vertical orientation during wafer processing at elevated temperatures between approximately 1000 °C to 1400 °C; and
- c) an arcuate lower grooved portion for receiving and supporting the lower area of the semiconductor wafers, wherein at least a part of the lower area of the semiconductor wafers contacts the lower arcuate grooved portion such that the lower arcuate grooved portion substantially conforms to the at least a part of the lower area of the semiconductor wafers that contact the arcuate lower grooved portion and which supports the weight of the semiconductor wafer positioned thereon; and
- d) at least one window positioned [not more than] a minimum of about 10 mm from the first and second ends of the boat, [wherein] whereby the one or more windows increase radiation [distribution about] view factors and decrease radiation blocking of the wafers in the boat when the boat undergoes processing at elevated temperatures.